A Forest Is More Than Trees

An Activity Guide for Teachers
Grade 5


Lama

Key Concepts:

- A forest is more than trees.
- Many different kinds of forests exist.
- Every forest contains a variety of habitats that support diverse, interdependent communities of plants and animals.
- A forest provides many benefits.
- Altering a forest environment affects all living things and interrelationships in an ecosystem.

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*This activity can be downloaded from www.dofaw.net on the Teacher Resources page

A Forest Is More Than Trees

Overview: Native Hawaiian rain forests are unique in the world. Forests are more than trees and each plant and animal relies on a community of other plants and animals to survive.

Classroom Activity:

- Using available worksheets, students will create a Hawaiian rain forest ecosystem and observe factors that impact it.

Objectives:

Students will be able to:

- distinguish between different forest types
- identify the layers of a forest
- discuss the use and conflicts that exist over use of forested lands
- apply knowledge of specific animal and plant needs in the Hawaiian rain forest
- recognize that altering a forest's environment affects all living things and interrelationships in that environment

Time Recommended:

- One or more 60 minute class period(s).

Materials Needed:

- Copies of worksheets provided (pages 12-16)
- Scissors
- Tape or Fun-Tak
- Pencil and paper

Hawai'i State Content Standards for Science (2005):

- **Topic:** Cycles of Matter & Energy/ Interdependence (Codes: 5.3.1 & 5.3.2)
- **Benchmarks:** 1. Decribe the cycle of energy among producers, consumers, and decomposers. 2. Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycle of matter (Addressed through completion of the Activity.)

Instructional Sequence:

Assess your students' prior knowledge. Ask students to quickly draw a picture of a tree. (Allow no more than 10 seconds.) Have students hold up their tree sketches and make comparisons. *Ask students what they would add to the sketch if they had time to draw a forest?* (Responses may include: more trees, different kinds of trees, animals in trees, etc.) Encourage students to mentally identify the sounds, smells, sights and feelings associated with forests. Record responses without comment on the board.

Concept #1: A forest is more than trees.

Divide students into small groups. Explain that they are going to have a contest to see which group can list the most forest plants and animals in three minutes. Students should use fairly specific plant and animal names. For example: list koa or ʻōhiʻa rather than just a tree. After three minutes, ask each group to read their list. Record each new plant or animal mentioned on the board. Student responses will provide insight as to their understanding of forests as more than tree-covered tracts of land.

Next. provide one minute for each group to identify a forest food chain from the plants and animals listed on the board. Have groups share their food chain with the class. Determine if you need to change or broaden any perceptions about the role plants play in food chains.

Building from student comments, lead students to understand that forests are more than just trees. Forests are diverse ecosystems that support many different plants and animals. Ask students to name some ways that forest animals and

Forest Food Chain

plants interact. (Examples might include: trees and other plants provide food and shelter for animals, insects pollinate flowers, or fungi and other decomposers break down dead material which enriches the soil so new plants can grow.)

Concept #2: Many different kinds of forests exist.

Ask students if all forests are the same? Responses will vary. Explain to students that while all forests have much in common, different types of forests exist. Hand out photocopies of the Forests of The World map. List the types of forests on the board as you briefly discuss their characteristics.

- Boreal forests are located in cold regions of the world. The growing season is short. Conditions are tough and a tree must be hardy to survive. Boreal forests are mostly coniferous forests. The characteristic pyramid shape of conifers helps the tree resist damage by heavy snow.

- Temperate forests are located in areas with moderate average temperatures that change with the seasons. These areas have less severe winters and have precipitation often spread evenly throughout the year. They generally have mix of broadleaf (deciduous) and coniferous trees.

- Tropical seasonal forests, also known as monsoon forests, have a long dry season followed by a very rainy season. They generally have broadleaf (deciduous) trees.

- Dry forests are located where temperatures are warm and there is little rainfall. They are characterized by more open woodlands or savannas with broadleaf (deciduous) trees. They often have less diversity of species than other forests.

- Tropical rain forests are found near the equator between the Tropic of Cancer and the Tropic of Capricorn. Temperatures are warm year-round. Rain forest trees are mostly broadleaf trees that lose their leaves gradually and remain green year-round. Tropical rain forests receive over 100 inches of rain per year. With all of the rain and sunshine, plant life is abundant. A typical temperate forest in the United States contains from 5 to 12 different types of trees, while a typical rain forest may have over 300 different types.

- Hawaiian rain forests are upside down. Because of the isolation of the Hawaiian islands, the forests evolved without predatory land mammals. This led to a very diverse understory ecosystem of plants, and animals. This is in contrast to most tropical rainforests where diversity is mostly high up in the canopy.

Have students look at their quick-sketch tree. Ask:
In what type of forests would you be most likely to find a tree like the one you drew?

‘Ōhi‘a lehua

Now looking at the map, ask students the following questions:
What type of forest is closest to your community?

By looking at the forest regions, what factors do you think influence where certain forests grow?

Answers include soil, climate, proximity to water, elevation, latitude, proximity to oceans and mountain ranges.

Have students look at the location of tropical rain forests on their map and estimate what percent of the total earth’s surface is covered by rain forest. After several guesses, tell students that rain forests cover only 2% of the earth’s surface, but are home to over half the world’s plants and animals! There is more diversity in tropical rain forests than anywhere else on earth.

Now have students look at the map of Hawai'i and the Pacific. Hawai'i is the most isolated archipelago in the world. This means that the plants and animals which settled in Hawai'i without the help of humans had to travel very long distances across the ocean in order to get here. There were only three ways they could get here, by: **wind, waves** or **wings**. This meant that native plants and animals evolved in Hawai'i under very different circumstances than plants and animals from other places in the world. For example no large land mammals were here since they could not make the journey without help from humans.

Ask your students what this might mean for the development of defenses for plants and animals.

In Hawai'i, plants and animals fall into two categories: Native (arrived by themselves) and Introduced (brought to Hawai'i with the help of humans). Native species can be either indigenous (found naturally in Hawai'i and elsewhere in the world) or endemic (found naturally in Hawai'i and nowhere else in the world). Because of Hawai'i's isolation, the numbers of endemic species are much higher than elsewhere in the world. About 100% of forest birds, 80% of plants, and 65% of arthropods native to Hawai'i are endemic. This makes Hawai'i very special but also very vulnerable.

New species that have arrived in Hawai'i since the arrival of humans have caused many changes. Many of the endemic plants and animals have since gone extinct. Many others are now endangered or threated. This means that if we don't help them, they may soon also become extinct.


'Ōpe'ape'a

Hand out a copy of the Hawaiian Rain Forest Worksheet (page 13) and Hawaiian Forest Information Sheets (pages 7-11) to each student (or small group). Explain to the students that they are going to create a Hawaiian rain forest ecosystem.

Concept #3: Every forest contains a variety of habitats that support diverse, interdependent communities of plants and animals.

Background information: A forest can be made up of many layers. Starting at the bottom and working up, the main layers of all forest types are the forest floor, the understory, and the canopy.

- Forest floor layer is comprised of decomposing leaves, animal droppings, dead trees and animals, all of which decay on the forest floor and create new soil and provide nutrients for the plants. Growing out of the forest floor are ferns, grasses, mushrooms, and tree seedlings.

- Understory layer is made up of bushes, shrubs, and young trees that have adapted to living in the shade of the canopy.


Koa

- Subcanopy is a middle layer, below the canopy and usually is formed by young trees on their way to becoming part of the canopy.

- Canopy is formed by the mass of intertwined branches, twigs, and leaves of the tall, mature trees. The crowns of the dominant trees receive most of the sunlight. This is where most of the tree's food is produced. The canopy forms a shady, protective "umbrella" over the rest of the forest.

In a forest ecosystem, each layer in the forest offers a different habitat site for forest inhabitants. Each layer has its own climate based on differences in light, temperature, humidity, and wind. Each layer provides a home and food for specific plants and animals.

Review the layers of the forest with your students as they look at the Hawaiian Rain Forest Worksheet. Then have students look at the Hawaiian

Forest Information Sheets. Explain that just a few of the many different kinds of trees, plants, and animals found in Hawai‘i are represented on these sheets. In a Hawaiian rain forest ecosystem, each forest layer is home to unique plants and animals, many not found anywhere else in the world.

Ask students to identify an animal or plant that lives in the canopy. (Palila, Pulelehua, etc.)

In most tropical rainforests, the canopy is the most diverse place in the forest. For example, in the Amazon, hundreds of thousands of plants and animals call the rain forest canopy home. Many never touch the ground during their lifetime. The canopy of tropical rainforests is a rich food source of fruits, flowers, leaves, and berries. Epiphytes, such as orchids, mosses, and bromeliads, are plants that grow without soil right on the trees of the canopy. Bromeliads have a cup-like shape that catches rain water. Insects lay their eggs and get food from the water-holding bromeliad, birds and bats arrive to eat the insects.. .and the food chain continues. In Hawai‘i, many plants and animals live in the understory or spend part of their time there. When walking through the Hawaiian rain forest, look around you and at your feet for the most diversity instead of up in the trees.

Ask students to find an animal or plant that lives in the understory (Pūpū kuahiwi, Hapu‘u, etc.).

Hapu‘u

Ferns, young canopy trees, vines and woody shrubs grow in the rain forest understory. They often have huge leaves to try to catch what little sun filters through from the canopy. Trees grow slowly until a canopy tree dies and falls. then the young trees take advantage of the shaft of sun and grow rapidly toward the sky. Many animals live here, including snails, insects, and introduced plants and animals. Fungi, use the organic litter as a source of food.

What animals live on the forest floor? (ie., predatory caterpillar, wild pig, rats, etc.)

The forest floor is covered with ferns, fungi, and a layer of rotting plant material (leaf litter) that has fallen from the layers above. The forest floor air is still and the humidity very high. In these conditions, the forest litter and dead trees on the floor decompose very rapidly releasing nutrients into the soil. A leaf that might take one year to decompose in a temperate climate will disappear in just six weeks on the rain forest floor. Large mammals, such as introduced wild pigs, forage for roots and tubers.

Concept #4: A forest provides many benefits.

Background information: Forests are great providers. They are a source of energy, collect water and influence water quality, preserve soil, absorb carbon dioxide, and create oxygen. Forests provide shelter and food for a variety of living things, provide raw materials for many of the products we use, and offer opportunities for recreation.

Not only is the tropical rain forest home to millions of plants and animals, but many products we use in our everyday lives come from rain forests around the world. Bananas, avocados, vanilla, shade-grown coffee, and cashews are all examples of rain forest products. Chicle, used in chewing gum, comes from a tropical tree. Chocolate, from the cacao seed, is also native to the tropical rain forest and oil from the cacao seed is used in suntan lotions, cosmetics and soaps. Latex, from the rubber tree, is used in making the rubber used in flexible tires for heavy equipment.

About one-fourth of all the medicines we use come from rain forest plants. The rosy periwinkle contains a chemical that fights leukemia (blood cancer). Curare, from a tropical vine, is used as an anesthetic and to relax muscles for surgery. More than 2,100 varieties of rain forest tropical plants possess cancer fighting properties.. and there may be many that have not even been discovered yet.

In Hawai'i, native Hawaiian culture is highly dependent on the plants, seeds and fruits gathered from the Hawaiian forest for spiritual and cultural practices. Some rain forest plants native to Hawai'i such as the palapalai fern are sacred to Hawaiians. Others, such as the ti plant were brought here by the Hawaiians from other Pacific islands. These are known as Polynesian introductions.

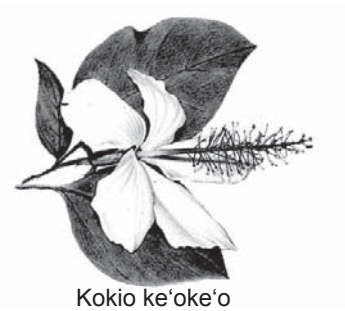
Concept #5: Altering a forest environment affects all living things and interrelationships in an ecosystem.

The introduction of alien species have many impacts on the native Hawaiian rain forest ecosystem.

Invasive alien species such as the Miconia plant can grow so big and fast in Hawai'i that it shades out native plants, which no longer get the sunlight they need to grow. Other aliens such as rats and mongooses eat native birds and their eggs, which can cause eventual extinction of the birds.

Other, slower changes caused by a combination of many aliens gradually moving into a native ecosystem cause eventual habitat loss for native plants and animals. In addition, if the alien species disturbs the soils they become less capable of absorbing moisture to recharge water sources in a watershed system. This affects all of us since we all drink the water provided by the Hawaiian rainforest sponge.

Following discussion of the five key concepts, make sure students are comfortable finding information on the Rain Forest Information Sheets, then begin the activity.



Kokio ke'oke'o

The Activity:

Explain that each student will now create a section of Hawaiian rain forest that when combined as a class will form an ecosystem. Hand out a copy of the Hawaiian Plant & Animal Rain Forest Cutout Sheet (page 12) to each student as well as pieces of tape or Fun Tak.

(A minimum of 12 sections of rain forest are needed for this activity. In a classroom of fewer than 12 students, have each student create two sections of rain forest.)

Remind students it takes many more plants and plant eaters at the bottom of the food chain to support a few animals at the top of the food chain.

Students should select from their cutout sheet:
4 carnivores
2 omnivores
3 herbivores
2 nectivores
1 insectivore
2 other plants (other than 'ōhi'a, māmane, koa, or naio)
Each image selected represents a population of that plant or animal that a section of rain forest can comfortably support.

Make sure that you place your plants and animals in the correct layer of the Hawaiian forest where they live. Any carnivore you put in your forest must have at least one of the animals it eats in the forest too. If you select the Kamehameha butterfly, what do you need to select for it to survive? If you select the Palila, what do you also need to select for it to survive?

Note: If an animal or plant is endangered, it means that there are so few left that, if we do not help them, they will become extinct very soon. Allow students 10-12 minutes to select and place their plants and animals in the correct forest layer on the Tropical Rain Forest Worksheet. (If using tape, remind students to roll the tape and place

their selections in lightly so they will be able to move them later.) While students are working, list all 24 plants and animals from the Information Sheets on the board and label a separate section of the board "Extinct or Endangered Species." When students have completed their rain forest section, conduct a forest inventory. Read the name of each plant/animal listed on the board and ask students to raise their hand if they have that animal or plant in their section. Record the number of each response on the board. If a plant or animal listed as native to Hawai'i is not used in any rain forest section, list it in the Extinct or Endangered section (except for plants or animals not native to Hawai'i.)

With a small class, put the completed rain forest sections side by side in three or four rows on the board or on a table where students can gather. With a larger class, students can remain at their desks and simply visualize that the desks represent the entire area of the rain forest ecosystem.

Select a student to represent an invasion of alien species and remove his or her section of rain forest. Remind students when trees in a section of rain forest are removed, the animals can move to try to find new homes, but the plants cannot and they die with that section of forest.

The student whose section was removed must try to find a home for his/her animals. The student must pass animals from his/her section of rain forest to students whose rain forest sections were adjacent to the section just removed. If the adjacent section does not already have that animal in its forest, then the animal may be placed there. If the animal already exists in that section of forest, the animal must be passed on to another adjacent rain forest section and so on until there is space and food for it to survive.

Remind students that if the animal needs a certain plant as food (example: Palila needs the Māmane tree) the new rain forest section must have that plant available in order for the animal to survive.

If no section of rain forest can take a particular animal, that animal dies and the picture is taped or tacked on the board by the animal name. (The student whose section of rain forest was removed may become the record keeper at the board.) Continue removing rain forest sections until the effect of alien invasion of the Hawaiian rain forest has impacted every student's rain forest section in one way or another. Conduct a second forest inventory and record the numbers on the board next to the starting numbers and discuss results. Closing discussion questions might include:
What effect did introducing alien species have on the plants and animals in this ecosystem?
How many populations of animals were lost?
Did any plants or animals become extinct?
What animals are in the most danger and why?
How would loss of rain forest affect our lives?
Why do alien species have such an impact on the Hawaiian rain forest ecosystem?

Explain that conflict exists over use of tropical rain forest land: pasture for cattle or habitat for many animals; hunting and recreation for people or native ecosystem integrity. Fencing of important habitat areas and removal of invasive alien species, land owner incentives and partnerships for protection of native ecosystems are just some of the things people are working on to try to preserve native Hawaiian rain forest land. Choices are tough and people have differing viewpoints about use of this forested land. Ask students, *what choices would you make?*


'I'iwi

ʻŌhiʻa (tree)
Forest habitat: canopy
found in dry , mesic, and wet forests
Plant use: food for birds, nesting sites, timber, medicine
Interesting facts: Different trees have different colors of flowers: red, yellow or salmon. The flowers secrete large amounts of nectar that birds and insects eat.
Native to Hawaiʻi: Yes

Māmane (bush, tree)
Forest habitat: understory
found in dry and mesic forests
Plant use: Hawaiian spears, food for birds and insects Interesting facts: It has golden yellow bean-like flowers, which produce very long green seed pods. Young twigs are silky and hairy .
Native to Hawaiʻi: Yes

Naio (tree)
Forest habitat: understory
found in dry , mesic, and rain forests
Plant use: birds depend on it for food
Interesting fact: The wood smells somewhat like sandalwood.
Native to Hawaiʻi: Yes

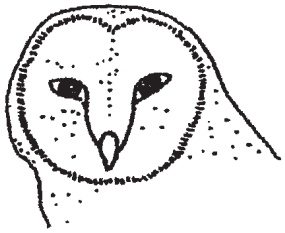
ʻ**Ohelo laʻau** (shrub)
Forest Habitat: understory
found in mesic and rain forests
Plant use: food for birds and animals, as medicine and to make jelly.
Interesting facts: ʻOhelo has small greenish flowers and large bright sour cranberry-like fruits. It is related to the blueberry and cranberry shrubs.
Native to Hawaiʻi: Yes

Koa (tree)
Forest Habitat: sub canopy, canopy
found in dry, mesic and wet forest
Plant use: furniture, lumber for building, food for birds, medicine, dye.
Interesting facts: Birds and butterflies depend on this tree for food. The leaves of a young tree look very different from that of a mature tree.
Native to Hawaiʻi: Yes

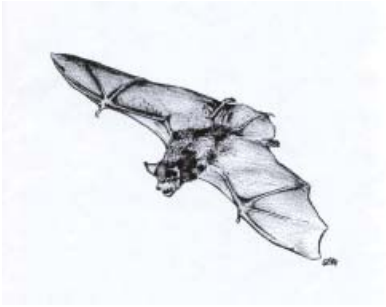
Strawberry Guava (bush, small bushy tree)
Forest habitat: understory, found in dry, mesic, and rain forests
Plant Use: Food for humans, birds, animals, dye, medicine, jelly, juice
Interesting facts: Introduced in 1825 for the edible fruit.
Native to Hawaiʻi: No

‘**Io** (Hawaiian Hawk, bird, carnivore)
Forest habitat: forest floor, canopy
Diet: Rodents, small birds, frogs, spiders, large insects, caterpillars, small birds.
Interesting facts: ‘Io can be solid brown to white with dark streaks.
Endangered: Yes
Native to Hawai‘i: Yes

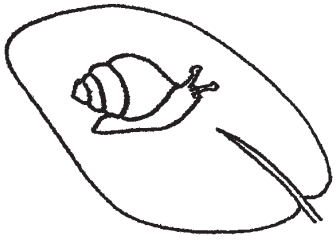
Pueo (Hawaiian Owl, bird, carnivore)
Forest habitat: forest floor, grasslands
Diet: Rodents, insects, small birds.
Interesting facts: Pueo hunt in the morning and evengings rather than at night. They have feathers on their legs and feet. Their faces are round with a black mask. They nest on the ground.
Endangered: Yes (only on Oahu)
Native to Hawai‘i: Yes.



Barn Owl (bird, carnivore)
Forest habitat: forest floor, grasslands
Diet: rodents, insects, small birds
Interesting facts: Its white, heart-shaped face distinguishes it from the native Pueo. It hunts primarily at night. They nest in tree cavities.
Endangered: No
Native to Hawai‘i: No



‘Ope‘ape‘a (Hawaiian Hoary Bat, mammal, insectivore)
Forest Habitat: In trees and rock outcroppings
Diet: beetles, insects, moths, termites, mosquitos.
Interesting facts: The ‘Ope‘ape‘a is grayish-brown with white-tipped fur. The fur looks like “hoar-frost”, hence its name. They forage for food at dawn and at dusk. They hang upside down to sleep.
Endangered: Yes
Native to Hawai‘i: Yes

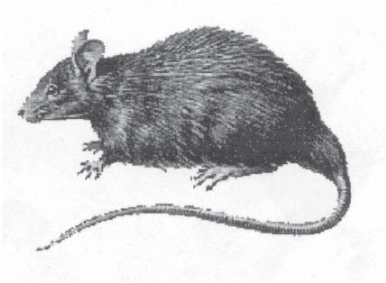


Pūpū kuahiwi (Oahu tree snail, herbivore)
Size: Shell length is less than an inch.
Forest Habitat: branches, bark and leaves, forest floor, understory
Diet: Algae and fungi that grow on trees and shrub leaves.
Interesting facts: People once thought these snails sang. They come in many colors depending on which valley is their home.
Endangered: Yes
Native to Hawai‘i: Yes

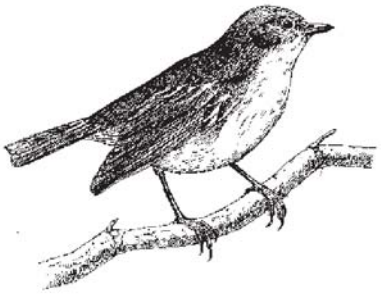
ʻIʻiwi (Hawaiian honeycreeper, bird, primarily nectivore)
Size: About 5” to 6” long
Forest habitat: Canopy and subcanopy
Diet: Adults drink nectar from Māmane and ʻŌhiʻa lehua blossoms. The chicks are fed insects.
Interesting facts: The young have orange-pink skin and a short straight bill. The adult bill is curved downward so it is very efficient at extracting nectar.
Endangered: Yes
Native to Hawaiʻi: Yes

Palila (bird, primarily herbivore)
Forest habitat: canopy, understory
Diet: Primary food is immature seeds in pods from Māmane trees. It also eats some insects, Naio berries, and Māmane seed pods.
Interesting facts: the finch-like bill is suited to open Māmane seed pods.
Endangered: Yes
Native to Hawaiʻi: Yes

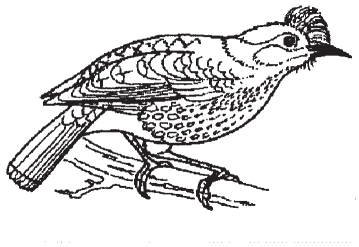
Rats and mice (mammals, omnivores)
Size: body lengths are 2” to 7”
Forest habitat: forest floor, gulches, and grasslands
Diet: Nuts, berries, fruit, seeds, birds, and eggs.
Interesting facts: There are 3 different kinds of rats in Hawaiʻi: Black rats, norway rats, and Polynesian rats and one kind of mouse. Besides fruit and other things, rats eat land snails and eggs of native birds. Mice eat seeds of all kinds including those of rare native plants.
Endangered: No
Native to Hawaiʻi: No



ʻOmaʻo (Hawaiian Thrush, bird, omnivore)
Size: About 7” long
Forest Habitat: canopy, subcanopy, understory
Diet: Primarily fruits, berries, seeds and insects.
Interesting facts: It builds its nest in Koa and ʻŌhiʻa trees. Adults will droop their wings and quiver like a baby bird begging for food.
Endangered: No
Native to Hawaiʻi: Yes

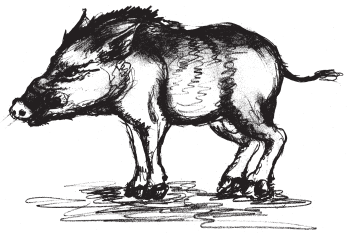


ʻĀkohekohe (Crested Honeycreeper, bird, primarily nectivore)
Size: About 7” long
Forest habitat: canopy and subcanopy
Diet: Primarily nectar from ʻŌhiʻa blossoms and other flowers, some insects.
Interesting facts: It has a distinctive crest of white or golden feathers on its forehead..
Endangered: Yes
Native to Hawaiʻi: Yes



Axis deer (mammal, herbivore)
Size: 95 to 225 lbs, shoulder height is 30” to 36”
Forest habitat: forest floor
Diet: All kinds of crops, grasses, and shrubs, including native species.
Interesting facts: Eight animals were introduced to Molokaʻi in 1867 as a gift to Kamehameha V. They are hunted as game today on Molokaʻi, Lānaʻi & Maui. Considered a highly invasive species.
Endangered: No
Native to Hawaiʻi: No

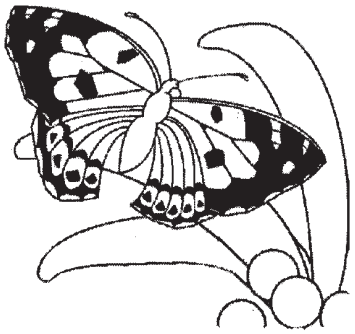
Puaʻa (wild pig, mammal, omnivore)
Size: Adults weight from 150 lbs. To more than 400lbs.
Forest habitat: forest floor
Diet: Favorite foods are earthworms and hapuʻu fern. They also eat roots, stems, and leaves of shrubs, grasses, snails, insects, ground nesting birds, and dig up turtle eggs on the Big Island.
Interesting facts: Early Polynesians and Europeans introduced the puaʻa as a source of food. Too much rooting by a herd causes erosion and destroys native forests. Found on all islands.
Endangered: No
Native to Hawaiʻi: No



Mongoose (mammal, omnivore)
Size: Total length is 18” to 26”
Forest habitat: Forest floor
Diet: Birds, eggs, insects, rodents, fruits, berries
Interesting facts: It was introduced to Hawaiʻi from India to control rats. But, Mongoose forage during the day and rats feed at night! They have been known to climb trees. Found on all islands but Kauaʻi and possibly Lānaʻi.
Endangered: No
Native to Hawaiʻi: No

Feral dog (mammal, carnivore)
Forest Habitat: Forest floor, grasslands
Diet: Game birds, Nēnē, rodents.
Interesting facts: People release pet dogs or lose hunting dogs and they either die or become feral, causing serious problems for our native wildlife.
Endangered: No
Native to Hawaiʻi: No

Pulelehua (Kamehameha butterfly, insect, adult is a nectivore, caterpillar is an insectivore)
Size: Wingspan is about 2.5 inches
Forest habitat: Canopy, understory
Diet: The butterfly eats sap oozing from tree wounds, especially the Koa tree, the caterpillar feeds on Mamaki leaves.
Interesting facts: Most active on sunny days. The chrysalis resembles a curled dead leaf of Mamaki. Young caterpillars roll a leaf and hide within for protection.
Endangered: Yes
Native to Hawai‘i: Yes



Predatory caterpillar (inchworm, insect, insectivore)
Size: body length is less then one inch
Forest habitat: forest floor, sub canopy
Diet: flies and other insects
Interesting facts: The caterpillar sits on twigs and small branches waiting in ambush for insects to approach from the rear. As soon as they touch its back end, the caterpillar rears back and pounces with its 6 claw-tipped front legs.
Endangered: No (not yet listed on the endangered species list)
Native to Hawai‘i: Yes

Hapu‘u (Hawaiian Tree fern)
Forest Habitat: understory, found in mesic and rain forests
Plant Use: Nesting site for birds, nature’s growing medium for ‘Ōhi‘a seedlings, for pillow and mattress stuffing. Ferns produce spores instead of seeds to reproduce. They are more primative than flowering plants.
Interesting facts: Hapu‘u produces no flowers, fruits or seeds.
Endangered: No
Native to Hawai‘i: Yes

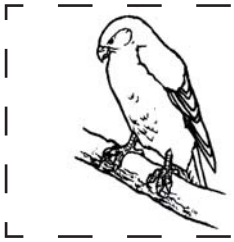
Mosquito (insect, herbivore)
Forest Habitat: Forest floor to canopy
Diet: Larvae eat minute plants in water. Adult males eat plant juices. Females drink blood.
Interesting facts: Whalers in Lahaina brought “wigglers” (mosquito larvae) to Hawai‘i in their water supply. Feed early morning and evenings, food for birds, bats.
Endangered: No
Native to Hawai‘i: No

Credits
Adaptation: Jolie Wanger, DOFAW Information & Education Specialist
Illustrations: The Nature Conservancy Oahu Program - Project Stewardship (forest layers diagram); Patrick Ching (I‘iwi); Steve Montgomery (Carnivorous Caterpillar); Mari Sakamoto (Native Hawaiian plant drawings); I Made Sumayasa (Pua‘a); Tammy Yee (Pulelehua); Ron Walker (Ope‘ape‘a)

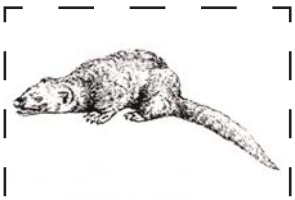
*Activity adapted by with permission from The 2001 Arbor Day National Poster Contest Activity Guide

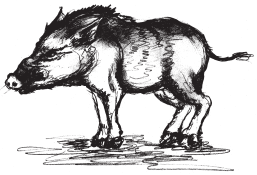
Directions:
Each picture represents a population of that plant or animal that could live in a section of forest. Cut them out and place in your forest. (Make copies of this page before cutting).
Remember the food chain - Each animal placed in the forest must have enough food to eat.

Carnivore

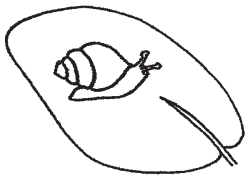



Omnivore

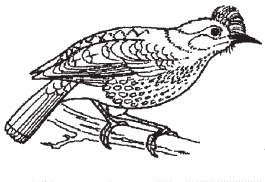
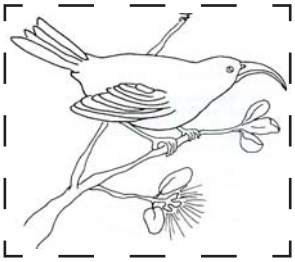
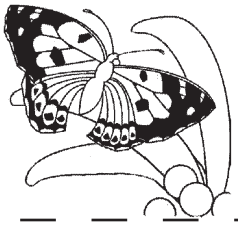


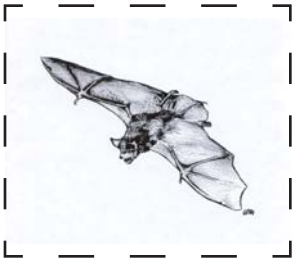
Herbivore




Nectivore

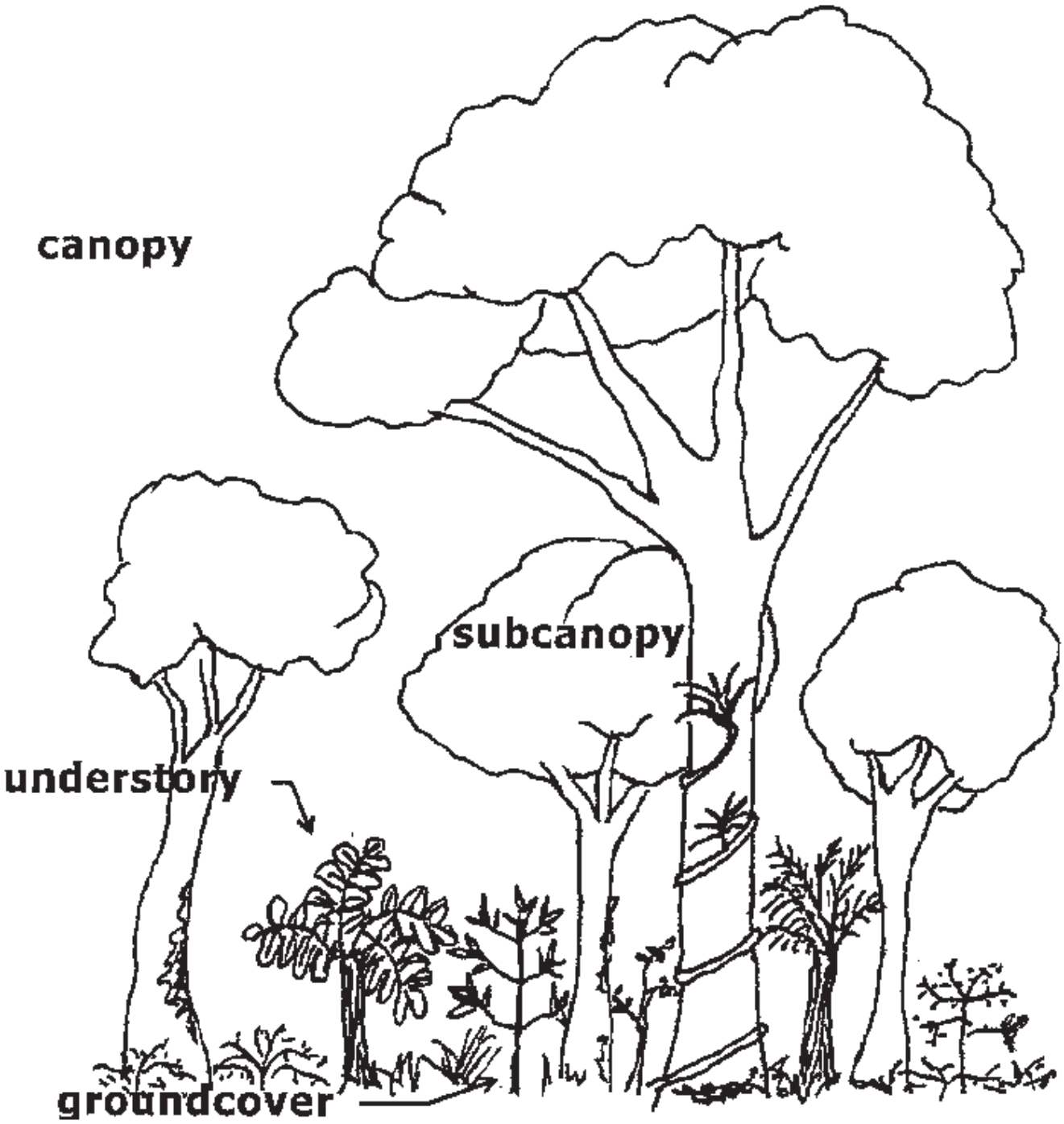
Insectivore

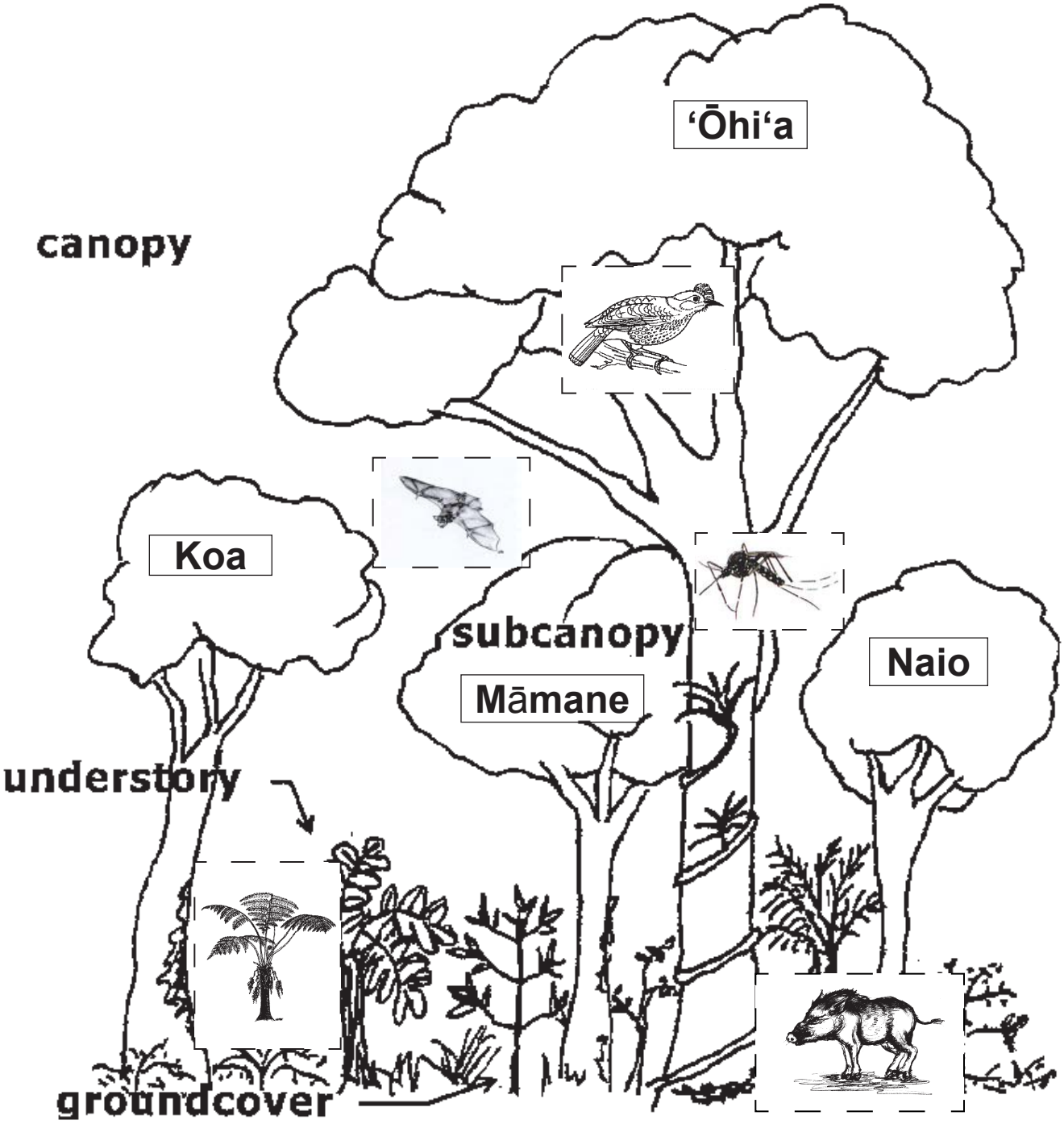
Other Plants



Major Layers of a Forest

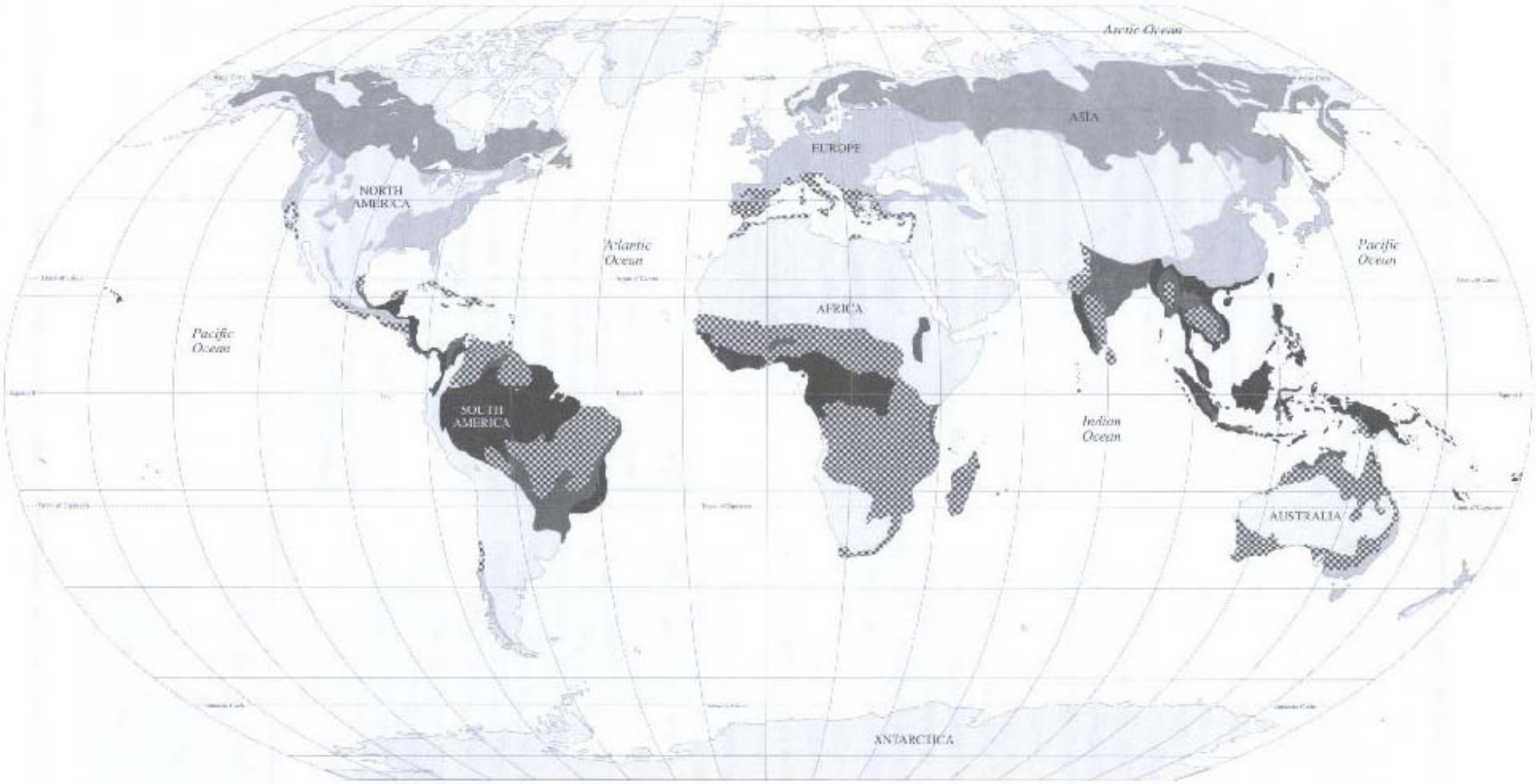


Major Layers of a Forest




Hawai‘i

Forests of the World



Tropical Rainforest

Tropical Seasonal Forest

Temperate Forest

Dry Forest

Boreal Forest